

FETAX ANALYSIS OF AMMONIUM PERCHLORATE

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J. A. Bantle Date 5/22/98

FETAX ANALYSIS OF AMMONIUM PERCHLORATE

Following a series of range finding tests designed to determine the appropriate concentrations, ammonium perchlorate was tested using FETAX (Frog Embryo Teratogenesis Assay: *Xenopus*) in accordance with the procedures outlined in the ASTM Standard Guide for FETAX¹. Three successful tests were conducted, two using glass dishes and one using plastic dishes. The percent mortality and malformation data from each test are summarized below in Tables 1 and 2 and Figure 1. The complete data sheets for each of these tests are attached as Appendix 1.

Table 1. Summary of Percent Mortality from FETAX tests.

Concentrations Tested	Test 7 Glass	Test 7 Plastic	Test 8 Glass	Test Average
Control	14	9	5	9
100	12	13	4	10
200	14	5	22	14
250	20	18	6	15
300	30	13	8	17
350	10	15	12	12
400	12	8	40	20
500	6	20	54	27
600	100	100	100	100

Table 2. Summary of Percent Malformation a from FETAX tests.

Concentrations Tested	Test 7 Glass	Test 7 Plastic	Test 8 Glass	Test Average
Control	6	0	3	3
100	9	6	17	11
200	14	16	5	12
250	8	12	23	14
300	17	23	46	29
350	40	32	50	41
400	27	32	100	53
500	58	91	100	83
600	NA	NA	NA	NA

most significant hazard. The LC₅₀, EC₅₀, upper and lower confidence intervals (CI) and the NOEC and LOEC concentrations are presented in Tables 3 and 4. The NOEC and LOEC concentrations for mortality are 271.8 and 356.0 mg/L respectively. Those for malformations are 203.3 and 247.2mg/L respectively. Also presented in Tables 3 and 4 are the LC₁₆, EC₁₆ and the LC₈₄ and EC₈₄. These data are presented graphically in the Probit plot (Figure 2).

Although there is some variation in the results obtained in the three tests (Tables 1 and 2), 100% embryo mortality is attained by 600 mg/L. The data indicate a relatively small lethal concentration range between 500 and 600 mg/L. The LC₅₀ for all tests is 496.1 mg/L (Table 3). Malformations appear to occur over a broader concentration range and the average EC₅₀ for all three tests is 396.1 mg/L (Table 4). The Teratogenic Index (TI), i.e., the ratio LC₅₀/EC₅₀, is 1.25 which suggests that ammonium perchlorate is not a significant teratogenic threat. Instead, embryo-toxicity is apparently the

¹ Standard Guide for Conducting the Frog Embryo Teratogenesis Assay-*Xenopus* (FETAX) 1991, E 1439 - 91.

Table 3. Mortality Data

	Concentration	Lower CI	Upper CI
NOEC	271.8	NA	NA
LOEC	356.0	NA	NA
LC ₁₆	383.6	364.33	403.93
LC ₅₀	496.1	397.41	619.32
LC ₈₄	641.6	609.32	675.55

Table 4. Malformation Data

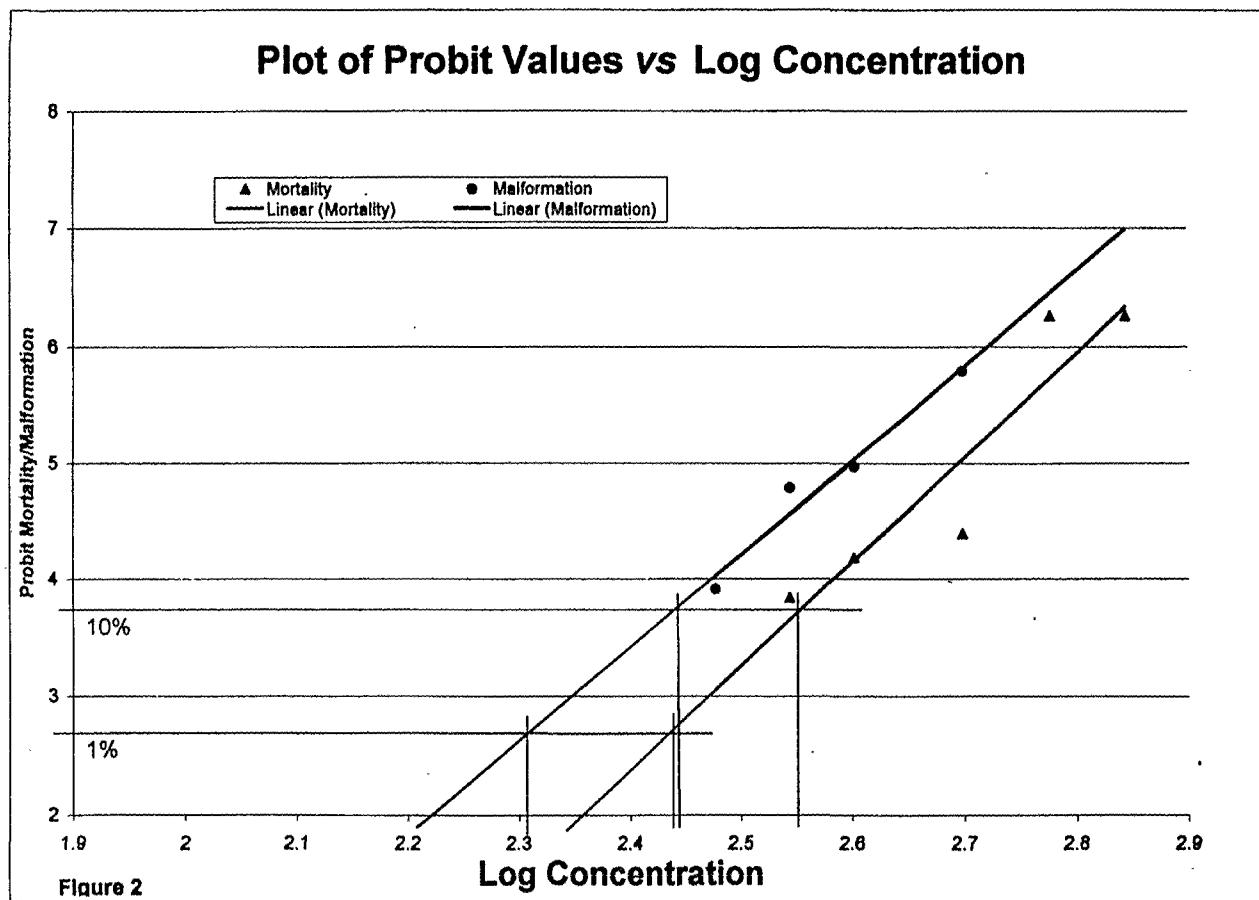
	Concentration	Lower CI	Upper CI
NOEC	203.3	NA	NA
LOEC	274.2	NA	NA
EC ₁₆	297.8	297.14	298.48
EC ₅₀	396.0	381.60	411.02
EC ₈₄	526.7	525.48	527.85

embryos eye development is abnormal; the eyes are not normally round, often displaying irregular outlines. Accompanying these abnormalities is the failure of the developing gut to coil normally. These malformations are dose dependent in that the more severe developmental consequences are found in embryos exposed to higher concentrations of perchlorate.

Embryo growth, i.e., length (growth) attained after 96 hours of exposure, is also affected. Figure 5 is a graphic presentation of this data. Both the average length attained by the embryos and the percent of length attained vs. control length are shown. In all cases the length of exposed embryos is significantly different ($p=0.05$) from the controls. Appendix 2 is the raw length data and the statistical calculations. Growth indicates teratogenic hazard when the MCIG (Minimum Concentration Inhibiting Growth) is $\leq 30\%$ of the 96 hr LC₅₀. The LC₅₀ is 496.1 mg/L and 30% of this value is 148.8 mg/L. Since the MCIG is 200 mg/L and greater than 143, there is no hazard as observed by this criterion.

In summary, the FETAX tests indicated that although severe malformations are caused, the TI and growth criteria suggest that perchlorate is embryotoxic and not teratogenic. All controls were within normal limits.

Typical malformations found in embryos exposed to perchlorate are shown in Figures 3 and 4. The most dramatic malformation is the dorsal curvature of the tail, which suggests abnormalities in the notochord, i.e., skeletal development. Additionally, malformations of the head and face are common. The head is reduced in size and appears flattened in the anterior-posterior axis. Such malformations also suggest abnormal development of the skeletal system. In some



Summary of FETAX Analysis of Ammonium Perchlorate

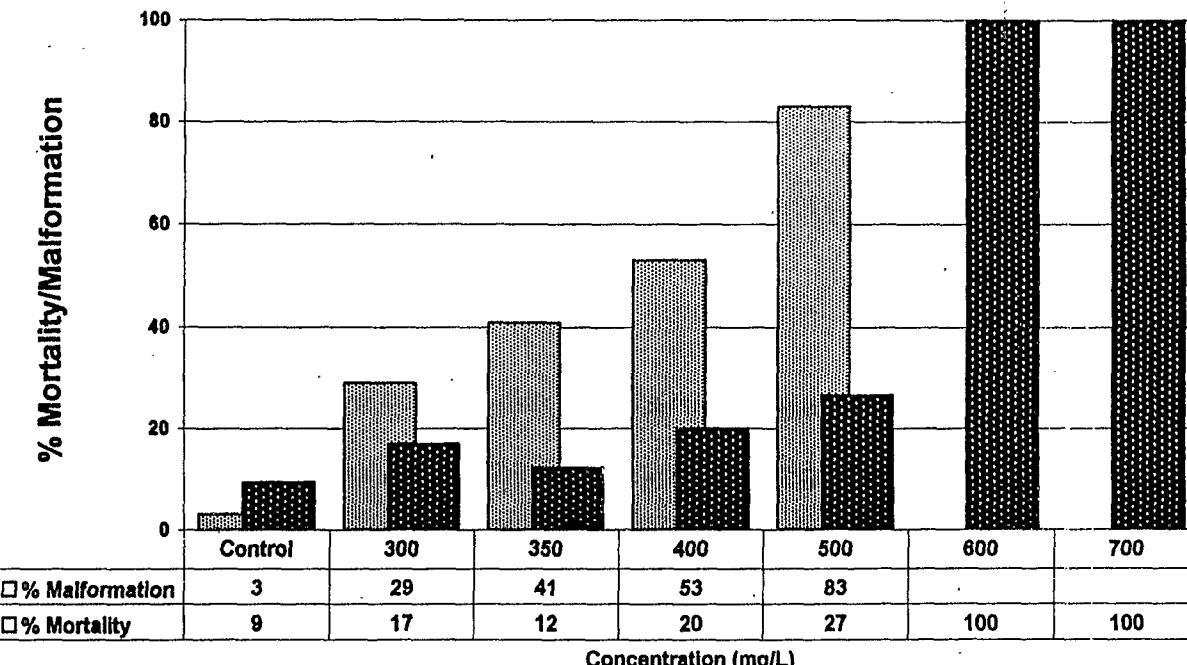


Figure 1

Summary of Growth Achieved by Embryos Exposed to Ammonium Perchlorate

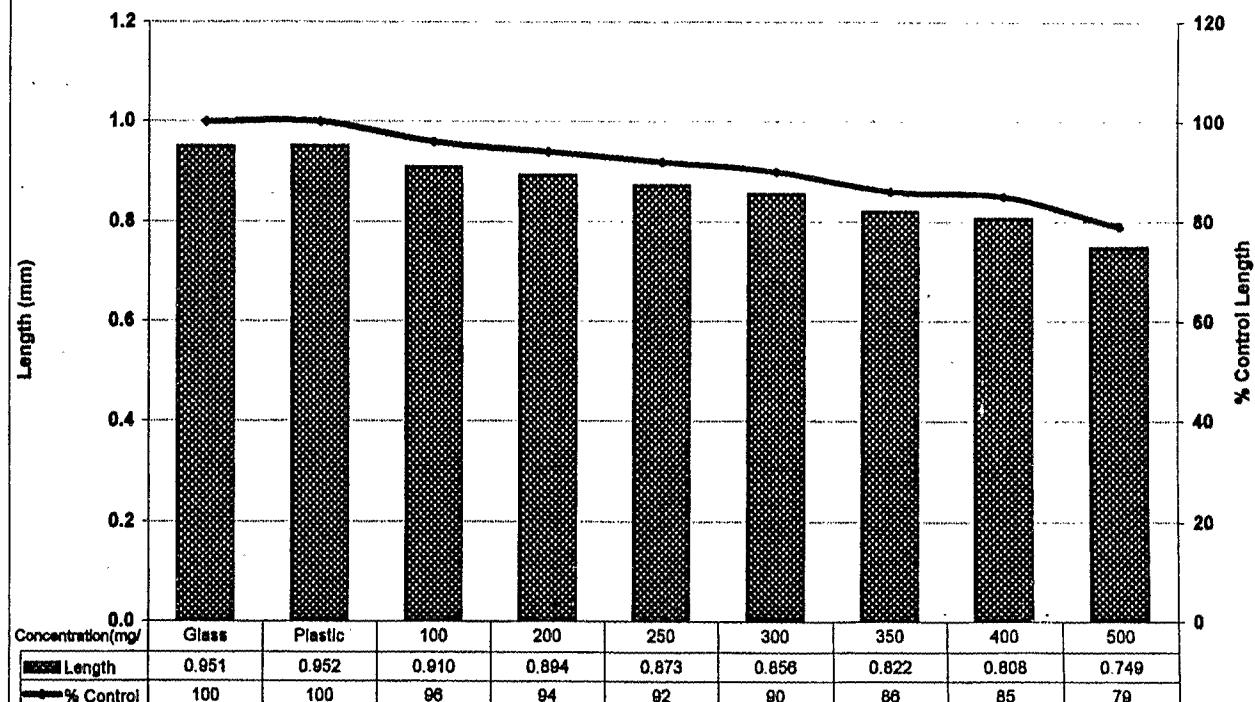


Figure 5



Figure 3. A 96 hour control embryo is at the top of the photo. The two embryos below it have been exposed to 400 mg/L of perchlorate for 96 hours. These embryos have malformed heads and faces and failure of the developing gut to coil properly. In addition the tails are abnormally curved dorsally.



Figure 4. These embryos have been exposed to 300 and 400 mg/L perchlorate. The embryo exposed to 400 mg/L is more severely deformed than the embryo exposed to 300 mg/L. Both have abnormally developed head and face regions and guts. The embryo exposed to 400 mg/L has an abnormal eye and a dramatic malformation of the tail.

APPENDIX 1

**DATA SHEETS FROM FETAX ANALYSIS OF AMMONIUM
PERCHLORATE**

FETAX SETUP and SUMMARY SHEET

Material or Test Code	PerChi-7	Test Number	7
Start Date	4/13/98	End Date	4/17/98
Test Material	Perchlorate	Investigator	J.. N. Dumont
Source/Supplier	Aldrich	Laboratory	Bantle/OSU
Catalog Number	20,850-7	Test Units (e.g., mg/L)	mg/L
Lot Number	Indicate Glass or Plastic Dishes & Solvent.		
Formula Weight	117.49	Use 25 embryos for glass and 20 for plastic dishes	Glass and Plastic
Purity	99.80%	Solvent/Concentration>	
Microsome Lot		Inducing Agent(s)	
Activity (U/mL)		Protein (ug/mL)	
FETAX CONTROLS			
CONTROL ID	% Mortality	% Malformation	Mating Pair
FETAX AB Control			Male No. 130
FETAX Control			Female No. 40
Solvent Control			
Glass Control	14	6	
Plastic Control	9	0	
MAS CONTROLS			
MAS Only Control			
Generator Only Control			
Enzyme Only Control			
Microsomes Only Control			
Carbon Monoxide/Sodium Dithionite			
CO Control			
Cyclophosphamide			
Positive Control			
Negative Control			
Acetic Hydrazide			
Positive Control			
Negative Control			
Test with Glass Dishes			
LC50	348 mg/L	EC50	449 mg/L
95% CI	308-392	95% CI	385-523
Control length	0.9378 mm	TI	0.78
MCIG	100 mg/L		
Test with Plastic Dishes			
LC50	477 mg/L	EC50	383 mg/L
95% CI	308-392	95% CI	289-505
Control length	0.9350 mm	TI	1.25
MCIG	200 mg/L		

MAS - Metabolic Activation System; CO - Carbon Monoxide; CI - Confidence Interval; TI - Teratogenic Index
 MCIG - Minimum Concentration that Inhibits Growth

This page is used to record test conditions, results obtained from controls, and final LC50, EC50 TI, and growth (MCIG) data. Not all species will be used depending upon the design and requirements of the test.

Select controls based on the specific requirements of the test.

Additional information on the microsomes is available from the Microsome Kit Record sheets.

COMPUTER FILE NAME

Perchlorate 7 Test Data

Enter the FILE NAME in the footer of each sheet.

CONTROL MORTALITY DATA

Investigator: J. N. Dumont Test Material: Perchlorate Test Material Code: PerCh-7
 Start Date: 13-Apr-98 Stock concentration: 1000 mg/L Test Number: 7 Microsome Lot

Client Date: 10-Apr-98 Check Concentration: 100 mg/ml Test Number: 14400000000000000000000000000000

FETAX CONTROL MORTALITY

If test is a MAS put "Y" in the MAS column ->	M A S	Stock mL	FETAX mL	24 hr		48 hr		72 hr		96 hr		Total		Total Number	Percent Mortality per dish		Replicate Mean Mortality
				1	2	1	2	1	2	1	2	1	2		1	2	
FX Control 1&2				2	0	1	3	0	0	0	1	3	4	7	12%	16%	
FX Control 3&4				1	0	2	3	0	0	1	0	4	3	7	16%	12%	14%
FXAB Control 1&2																	
FXAB Control 3&4																	
Solvent Control 1&2																	
Solvent Control 3&4																	
Glass 1&2																	
Glass 3&4																	
Plastic 1&2				1	0	1	1	0	0	0	2	2	3	5	10%	15%	20% (PVC)
Plastic 3&4				0	0	0	1	0	1	0	0	0	2	2	0%	10%	9%

MAS CONTROL MORTALITY

NOTES

FX, FETAX Solution: FXAB, FETAX Solution with Antibiotics; MAS, Microsomes Activation System; CO, Carbon Monoxide; CP, Cyclophosphamide; AH, Acetic Hydrazide.

Investigator: J.. N. Dumont				Test Material Code PerChl-7				Number 7														
Start Date: 13-Apr-98				Test Material: Perchlorate				Units 1000 mg/L														
Control ->	FX Control		FXAB Control		Solvent Control		Glass Control		Plastic Control		MAS Control	Generator Control	Enzyme Control	Microsome Control	Carbon Monoxide	CP+ Control	CP- Control	AH+ Control	AH- Control			
Replicate/Dish No. ->	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2	1	2
Severe																						
Stunted																						
Gut																						
Edema: Multiple																						
Cardiac																						
Abdominal																						
Facial																						
Cephalic																						
Optic																						
Tail																						
Notochord																						
Fin																						
Face																						
Eye																						
Brain																						
Hemorrhage																						
Cardiac																						
Blister																						
Other-specify																						
No. Malformed	1	0	2	2																		
No. Living	22	21	21	22																		
Percent Effect	0	0%	10%	8%																		
Mean Percent	6%																					

It is not always necessary to collect specific malformation type data for the controls indicated by the shaded cells above. However, the number of malformations is always recorded. Therefore, the cells for entering the numerical data for calculation of the percent of malformations have been left unshaded. Two columns have been left untitled for any unique controls that may be required for some tests.

TEST MATERIAL MORTALITY DATA

Investigator:	J.. N. Dumont		Test Material:	Peroxide		Test Material Code:	PerChi-7							
Start Date:	13-Apr-98		Stock concentration:	0%	Test Number:	7	Microsome Lot							
If test is a MAS test put "Y" in the MAS column ----->	M A S	Stock mL	FETAX mL	FETAX MORTALITY										
				24 hr Dishes	48 hr Dishes	72 hr Dishes	96 hr Dishes	Total per replicate	Total Number	Percent Mortality per dish	Replicate Mean Mortality			
Sample ID/Concentration									Dead	1	2			
GLASS														
100				1	0	1	1	0	3	12%	12%			
200				1	1	1	0	0	7	12%	28%			
250				0	0	3	1	3	10	16%	40%			
300				4	3	2	2	1	15	28%	60%			
350				0	2	1	0	1	5	12%	20%			
400				1	1	3	0	0	6	8%	24%			
500				1	0	0	2	0	3	8%	12%			
600				0	1	0	1	1	50	100%	200%			
700				2	0	6	2	17	25	100%	200%			
PLASTIC														
100				0	2	1	1	0	5	5%	20%			
200				0	1	0	1	0	2	0%	10%			
250				0	0	0	2	0	7	10%	25%			
300				1	0	0	1	1	5	15%	10%			
350				1	0	0	0	1	6	20%	10%			
400				0	0	1	0	1	3	10%	5%			
500				1	1	1	1	1	8	20%	20%			
600				2	1	1	1	9	20	100%	100%			
700				5	3	0	1	16	40	100%	100%			

These FETAX Data Sheets are designed to accommodate up to 20 separate samples or concentrations. If more spaces are required, use an additional sheet.

Notes:

Investigator: J.. N. Dumont				Test Material Code			PerChl-7			Test Number			7	TEST MATERIAL MALFORMATION DATA												
Start Date: 13-Apr-98				Test Material: Perchlorate						Units			mg/L													
Test Concentration →	GLASS	100	200	250	300	350	400	500	600	700	PLASTIC	100	200	250	300	350	400	500	600	700						
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
Replicate/Dish No. →	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
Severe		x		x																		x				
Stunted																										
Gut			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Edema: Multiple		x						x										x	x							
Cardiac				x		x																				
Abdominal				x	x	x		x																		
Facial																										
Cephalic																										
Optic																										
Tail				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Notochord																										
Fin																										
Face					x																					
Eye					x																					
Brain					x																					
Hemorrhage																										
Cardiac																										
Blister																										
Other-specify																										
No. Malformed	2	4	2	2	1	1	5	5	13	4	8	11	17						1	1	3	3	4	0	4	4
No. Living	22	21	22	19	21	17	18	23	22	21	23	24	23						18	18	20	18	18	18	18	18
Percent Effect	9%	10%	9%	11%	6%	6%	26%	22%	56%	18%	36%	46%	74%						8%	8%	15%	17%	22%	0%	24%	22%
Mean Percent	9.00%	13.95%	7.50%	17.14%	4.00%	27.27%	59.57%												5.71%	15.70%	12.12%	22.85%	32.33%	32.47%	90.83%	

IF MORE SAMPLES/CONCENTRATIONS ARE TESTED THAN FIT ON THIS FORM, USE A SECOND COPY TO RECORD THE REMAINING DISHES.

Notes:

FETAX TEST VARIABLE REPORT

Investigator:	J.. N. Dumont		Test Number:	7		
Start Date:	4/13/98		Test Material:	Perchlorate		
Incubator Temperature						
	Time	0 hr	24 hr	48 hr	72 hr	96 hr
Temperature:		24	24	24	24	24
Sample pH						
<p>If different samples are run at the same concentration (e.g., water samples from a variety of collection sites), it will be necessary to record the pH of each sample daily. Page 7 can be used to list sample IDs for recording the daily pH.</p>						
	Time	0 hr	24 hr	48 hr	72 hr	96 hr
FX Solution Control			7.24	7.05	7.02	7.53
Control - Plastic			7.53	7.28	7.08	7.54
High Concentration*						
MAS Control						
MAS High Concentration*						
Dissolved Oxygen (use when sealed jars are used for exposures)						
	Time	0 hr	24 hr	48 hr	72 hr	96 hr
Stock						-----
Control						
High Concentration*						
MAS Control						
MAS High Concentration*						
Location of dishes in Incubator:	Middle Shelves					
Sample (Test Material) location:	LSW 317					
Embryo Archive location:	LSW 317					
Computer location where data are stored:	LSW 317					
Computer Drive:	C:/	File Name:	Perchlorate - 7 Test Data			
Notes:						

*highest surviving concentration

Sample pH

MORTALITY and MALFORMATION SUMMARY

Investigator:		J. N. Dumont	Test Number:	7
Start Date:	4/13/98	Test Material:	Perchlorate	
	Test Material Code	PerChl-7	Microsome Lot No.	
C O N T R O L D A T A	Control	Percent Mortality	Percent Malformed	MAS*
	FX Control			
	FXAB Control			
	Solvent Control			
	Glass	14	6.00	
	Plastic	9	0.00	
	MAS Only Control			
	Generator Control			
	Enzyme Control			
	Microsome Control			
T E S T M A T E R I A L D A T A	CO Control			
	CP+			
	CP-			
	AH+			
	AH-			
	GLASS			
	100	12	9.09	
	200	14	13.95	
	250	20	7.50	
	300	30	17.14	
P L A S T I C	350	10	40.00	
	400	12	27.27	
	500	6	57.50	
	600	100		
	700	100		
	PLASTIC			
	100	13	6.00	
	200	5	16.00	
	250	18	12.00	
	300	13	23.00	

* Check if test was with MAS.

Material or Test Code	PerChl-8	Test Number	8
Start Date	4/14/98	End Date	4/18/98
Test Material	Perchlorate	Investigator	J.. N. Dumont
Source/Supplier	Aldrich	Laboratory	Bantle/OSU
Catalog Number	20,850-7	Test Units (e.g., mg/l.)	mg/L
Lot Number		Indicate Glass or Plastic Dishes & Solvent.	
Formula Weight	117.49	Use 25 embryos for glass and 20 for plastic dishes	Glass and Plastic
Purity	99.80%	Solvent/Concentration>	
Microsome Lot		Inducing Agent(s)	
Activity (U/mL)		Protein (ug/mL)	
FETAX CONTROLS			
CONTROL ID	% Mortality	% Malformation	Mating Pair
FETAX AB Control			Male No. 76
FETAX Control			Female No. 122
Solvent Control			
Glass Control	5	3.16	
Plastic Control	5	0.00	
MAS CONTROLS			
MAS Only Control			This page is used to record test conditions, results obtained from controls, and final LC50, EC50 TI, and growth (MCIG) data. Not all spaces will be used depending upon the design and requirements of the test. Select controls based on the specific requirements of the test.
Generator Only Control			
Enzyme Only Control			
Microsomes Only Control			
Carbon Monoxide/Sodium Orlonite			
CO Control			Additional information on the microsomes is available from the Microsome Kit Record sheets.
Cyclophosphamide			
Positive Control			
Negative Control			COMPUTER FILE NAME
Acetic Hydrazide			
Positive Control			Perchlorate 8 Test Data
Negative Control			Enter the FILE NAME in the footer of each sheet.
Without the Metabolic Activation System			
LC50	429 mg/L	EC50	313
95% CI	210-339	95% CI	132-743
Control length	0.9644	TI	1.37
MCIG	100 mg/L		
With the Metabolic Activation System			
LC50		EC50	
95% CI		95% CI	
Control length		TI	
MCIG		95% CI	

MAS - Metabolic Activation System; CO - Carbon Monoxide; CI - Confidence Interval; TI - Teratogenic Index
 MCIG - Minimum Concentration that Inhibits Growth

CONTROL MORTALITY DATA

Investigator:	J.. N. Dumont		Test Material:	Perchlorate		Test Material Code:	PerChi-8											
Start Date:	14-Apr-98		Stock concentration:	1000 mg/L		Test Number:	8											
FETAX CONTROL MORTALITY																		
If test is a MAS put "Y" in the MAS column ->	M A S	Stock mL	FETAX mL	24 hr		48 hr		72 hr		96 hr		Total		Total Number Dead	Percent Mortality per dish		Replicate Mean Mortality	
				1	2	1	2	1	2	1	2	1	2		1	2		1
FX Control 1&2				0	1	0	0	1	0	1	0	2	1	3	8	12		
FX Control 3&4				0	0	0	0	0	0	2	0	2	0	2	8	8	5	
FXAB Control 1&2																		
FXAB Control 3&4																		
Solvent Control 1&2																		
Solvent Control 3&4																		
Glass 1&2																		
Glass 3&4																		
Plastic 1&2				1	0	0	0	0	0	1	2	2	2	4	10	20	5	
Plastic 3&4																		
MAS CONTROL MORTALITY																		
MAS Only Control																		
Generator Control																		
Enzyme Control																		
Microsome Control																		
CO Control																		
CP+, 4 mg/mL																		
CP-, 4 mg/mL																		
AH+																		
AH-																		
NOTES																		
<hr/>																		

FX, FETAX Solution; FXAB, FETAX Solution with Antibiotics; MAS, Microsome Activation System; CO, Carbon Monoxide; CP, Cyclophosphamide; AH, Acetic Hydrazide

Investigator: J. N. Dumont				Test Material Code: PerChI-8				Number: 8								
Start Date: 14-Apr-98				Test Material: Perchlorate				Units: 1000 mg/L								
Control ->	FX Control	FXAB Control	Solvent Control	Glass Control	Plastic Control	MAS Control	Generator Control	Enzyme Control	Microsome Control	Carbon Monoxide Control	CP+ Control	CP- Control	AH+ Control	AH- Control		
Replicate/Dish No. ->	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2
Severe	x															
Stunted		x														
Gut																
Edema: Multiple	x		x													
Cardiac																
Abdominal																
Facial																
Cephalic																
Optic																
Tail																
Notochord																
Fin																
Face																
Eye																
Brain																
Hemorrhage																
Cardiac																
Bilateral																
Other-specify																
No. Malformed	1	0	1	1					0	0						
No. Living	23	24	23	25					24	23						
Percent Effect									0	0						
Mean Percent	3.16								0.00							

It is not always necessary to collect specific malformation type data for the controls indicated by the shaded cells above. However, the number of malformations is always recorded. Therefore, the cells for entering the numerical data for calculation of the percent of malformations have been left unshaded. Two columns have been left unshaded for any unique controls that may be required for some tests.

TEST MATERIAL MORTALITY DATA

These FETAX Data Sheets are designed to accommodate up to 20 separate samples or concentrations. If more spaces are required, use an additional sheet.

Notes:

Investigator:	J. N. Dumont				Test Material Code				PerChi-8				Test Number				8							
Start Date:	14-Apr-98				Test Material: Perchlorate								Units				mg/L							
Test Concentration →	GLASWS	100	200	250	300	350	400	500	600	700			100	200	250	300	350	400	500	600	700			
Replicate/Dish No. →	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
Severe	X	X	X																					
Stunted																								
Gut				X	X	X	X	X	X	X	X	X												
Edema: Multiple	X	X	X		X								X											
Cardiac			X																					
Abdominal																								
Facial																								
Cephalic																								
Optic																								
Tail				X	X	X	X	X	X	X	X	X												
Notochord																								
Fin																								
Face																								
Eye																								
Brain																								
Hemorrhage																								
Cardiac																								
Blister																								
Other-specific																								
No. Malformed	1	7	1	1	4	7	9	12	7	15	6	24	23											
No. Living	25	23	17	22	25	22	23	23	23	21	6	24	23	0	0	0	0	0						
Percent Effect	4	30.43	6.662	4.645	16	31.82	36.13	52.17	30.43	71.43	100	100	100	0	0	0	0	0	0	0	0	0	0	0
Mean Percent	16.67	5.13	23.40	45.65	50.00	100.00	100.00																	

IF MORE SAMPLES/CONCENTRATIONS ARE TESTED THAN FIT ON THIS FORM, USE A SECOND COPY TO RECORD THE REMAINING DISHES.

Note:

FETAX TEST VARIABLE REPORT

Investigator:	J.. N. Dumont		Test Number:	8	
Start Date:	4/14/98		Test Material:	Perchlorate	
Incubator Temperature					
Time	0 hr	24 hr	48 hr	72 hr	96 hr
Temperature:	24	24	24	24	24
Sample pH					
<p>If different samples are run at the same concentration (e.g., water samples from a variety of collection sites), it will be necessary to record the pH of each sample daily. Page 7 can be used to list sample IDs for recording the daily pH.</p>					
Time	0 hr	24 hr	48 hr	72 hr	96 hr
FX Glass	7.5	7.13	6.96	6.99	7
FX Plastic		7.41	7.04	7.15	7.19
High Concentration*					
MAS Control					
MAS High Concentration*					
Dissolved Oxygen (use when sealed jars are used for exposures)					
Time	0 hr	24 hr	48 hr	72 hr	96 hr
Stock					-----
Control					
High Concentration*					
MAS Control					
MAS High Concentration*					
Location of dishes in Incubator:	Middle shelf				
Sample (Test Material) location:	LSW 315				
Embryo Archive location:	LSW 315				
Computer location where data are stored:	LSW 315				
Computer Drive:	C:/	File Name:	Perchlorate - 8 Test Data		
Notes:					

*highest surviving concentration

Sample pH

MORTALITY and MALFORMATION SUMMARY

	Investigator:	J.. N. Dumont	Test Number:	8
Start Date:	4/14/98	Test Material:	Perchlorate	
	Test Material Code	PerChl-8	Microsome Lot No.	
C O N T R O L D A T A	Control	Percent Mortality	Percent Malformed	MAS*
	FX Control			
	FXAB Control			
	Solvent Control			
	Glass	5	3.16	
	Plastic	5	0.00	
	MAS Only Control			
	Generator Control			
	Enzyme Control			
	Microsome Control			
	CO Control			
	CP+			
	CP-			
	AH+			
	AH-			
T E S T M A T E R I A D A T A	100	4	16.67	
	200	22	5.13	
	250	6	23.40	
	300	8	45.65	
	350	12	50.00	
	400	40	100.00	
	500	54	100.00	
	600	100		
	700	100		

* Check if test was with MAS.

APPENDIX 2

**GROWTH DATA FORM EMBRYOS EXPOSED TO AMMONIUM
PERCHLORATE**

PERCHLORATE 7 GLASS LENGTH DATA

"FXPL"	"FXGL"	100	200	250	300	350	400	500
0.96373	0.96061	0.98656	0.91685	0.89343	0.89124	0.80349	0.83156	0.80536
0.98884	1.00691	0.78485	0.98704	0.92504	0.90559	0.82198	0.74869	0.84627
0.96393	0.78118	0.96457	0.94291	0.90222	0.87194	0.85226	0.84297	0.86082
0.96692	0.93747	1.02151	0.89825	0.88869	0.86749	0.80232	0.85362	0.62271
0.93379	0.90526	0.96048	0.92528	0.7306	0.83072	0.82046	0.83378	0.87992
0.97269	0.92132	0.94884	0.92726	0.93954	0.86448	0.78581	0.79715	0.85641
0.94552	0.90903	0.92383	0.73645	0.85736	0.92052	0.86048	0.84011	0.90602
0.98199	0.92497	0.91789	0.93571	0.82947	0.85325	0.81388	0.7419	0.87565
0.91786	0.90092	0.97199	0.89668	0.94689	0.91062	0.80089	0.82144	0.86737
0.96128	0.91101	0.91875	0.92415	0.88574	0.91085	0.83179	0.79509	0.69761
0.90314	0.93876	0.67784	0.86882	0.88146	0.89132	0.78051	0.81116	0.8644
0.83935	0.95034	0.92044	0.9767	0.9446	0.88723	0.86229	0.79206	0.83971
0.99366	0.95149	0.98455	0.95705	0.90969	0.87378	0.8378	0.78893	0.79373
0.95838	0.95951	1.02425	0.96098	0.88006	0.89158	0.8359	0.73885	0.86055
0.99311	0.94727	1.0112	0.937	0.87732	0.91597	0.83185	0.86111	0.91143
0.91016	0.98058	0.83245	0.94917	0.87736	0.87343	0.81925	0.76093	0.8587
0.92625	0.95022	0.96884	0.94945	0.86756	0.80179	0.84236	0.86664	0.82866
0.95758	0.94702	0.90089	0.92512	0.91382	0.81269	0.76094	0.83109	0.87533
0.97496	0.97021	0.97615	0.93061	0.90796	0.85807	0.8261	0.80491	0.87383
0.90492	0.93262	0.9011	0.93262	0.85264	0.86449	0.84738	0.84596	0.86662
0.88148	0.93301	"	0.96448	0.88506	0.86563	0.88279	0.87906	0.76553
0.97178	0.94264	"	0.81294	0.91625	0.88752	0.86723	0.82564	0.85593
0.99666	0.89205	"	0.86759	0.92008	0.86632	0.87873	0.8635	0.88482
0.94238	0.94347	"	0.97188	0.89293	0.86378	0.78391	0.8601	0.86102
0.67142	0.96808	"	0.73046	0.91569	0.8777	0.79761	0.81946	0.81014
0.89468	0.97044	"	0.83587	0.92531	0.91767	0.79704	0.82745	0.80242
0.90446	0.96389	"	0.98015	0.84196	0.856	0.80864	0.84393	0.81043
0.9381	0.9275	"	0.90014	0.8437	0.76543	0.76443	0.84835	0.71239
0.98619	0.99122	"	0.94513	0.88962	0.803	0.76917	0.83436	0.7745
0.9419	0.97159	"	0.90081	0.90876	0.87103	0.78697	0.84343	0.4984
0.95665	0.99182	"	0.93829	0.63604	0.93048	0.7592	0.78834	0.72595
0.91443	0.96655	"	0.94242	0.88084	0.76627	0.81032	0.85011	0.67656
0.89526	1.00244	"	0.9133	0.85883	0.8054	0.80376	0.85872	0.7406
"	0.92658	"	0.92624	0.87976	0.84088	0.80173	0.77693	0.68847
"	0.96908	"	0.85785	0.91978	"	0.79206	0.80369	0.72865
"	0.969	"	0.87094	0.91659	"	0.72758	0.82129	0.71837
"	0.99788	"	0.2512	0.91919	"	0.82298	0.84079	0.73456
"	0.96386	"	0.93126	0.899	"	0.78619	0.80268	0.69663
"	1.00916	"	0.9037	0.92556	"	0.75483	"	0.80289
"	0.97393	"	0.95568	"	"	0.82637	"	0.77454
"	0.97626	"	0.89084	"	"	0.66036	"	0.61431
"	0.96004	"	0.90595	"	"	0.81046	"	0.72593
"	0.95332	"	0.7805	"	"	0.79515	"	0.76659
"	0.92165	"	0.96181	"	"	0.75104	"	0.77458
"	0.96055	"	0.9282	"	"	0.72557	"	0.76156
"	0.93744	"	"	"	"	0.80073	"	0.7513
"	0.89867	"	"	"	"	"	"	0.79035
"	0.87806	"	"	"	"	"	"	"
"	0.98369	"	"	"	"	"	"	"
"	0.98229	"	"	"	"	"	"	"
"	1.01713	"	"	"	"	"	"	"
"	0.99232	"	"	"	"	"	"	"
"	0.76779	"	"	"	"	"	"	"
"	0.85817	"	"	"	"	"	"	"
"	0.90124	"	"	"	"	"	"	"

**	0.98346	**	**	**	**	**	**	
**	0.90931	**	**	**	**	**	**	
**	0.90435	**	**	**	**	**	**	
**	0.90818	**	**	**	**	**	**	
**	0.63658	**	**	**	**	**	**	
**	0.91678	**	**	**	**	**	**	
**	0.91435	**	**	**	**	**	**	
**	0.87405	**	**	**	**	**	**	
**	1.00557	**	**	**	**	**	**	
**	0.9778	**	**	**	**	**	**	
**	0.86132	**	**	**	**	**	**	
**	0.97425	**	**	**	**	**	**	
**	0.97252	**	**	**	**	**	**	
**	0.95861	**	**	**	**	**	**	
**	1.00395	**	**	**	**	**	**	
**	0.97004	**	**	**	**	**	**	
**	0.96574	**	**	**	**	**	**	
**	0.75029	**	**	**	**	**	**	
**	0.94022	**	**	**	**	**	**	
**	0.8436	**	**	**	**	**	**	
**	0.92388	**	**	**	**	**	**	
**	0.97577	**	**	**	**	**	**	
**	0.96801	**	**	**	**	**	**	
**	0.97708	**	**	**	**	**	**	
**	0.98962	**	**	**	**	**	**	
**	0.91442	**	**	**	**	**	**	
**	0.9305	**	**	**	**	**	**	
FXPL	*FXGL*	100	200	250	300	350	400	500
0.9350	0.9378	0.9298	0.8988	0.8843	0.8664	0.8044	0.8204	0.7881
99.70%	100.00%	99.15%	95.84%	94.29%	92.39%	85.78%	87.48%	84.03%

t-Test: Two-Sample Assuming Unequal Variances

FXGL		*FXPL*		*FXGL*		100		*FXGL*		200	
Mean	0.93778	0.93495	Mean	0.93778	0.92985	Mean	0.938	0.899	Mean	0.938	0.899
Variance	0.00369	0.00365	Variance	0.00369	0.00706	Variance	0.004	0.013	Variance	0.004	0.013
Observations	82	33	Observations	82	20	Observations	82	45	Observations	82	45
Hypothesized Mean Diff.	0		Hypothesized Mean	0		Hypothesized Mean	0		Hypothesized Mean	0	
df	59		df	.24		df	58		df	58	
t Stat	0.22685		t Stat	0.39764		t Stat	2.138		t Stat	2.138	
P(T<=t) one-tail	0.41066		P(T<=t) one-tail	0.34721		P(T<=t) one-tail	0.018		P(T<=t) one-tail	0.018	
t Critical one-tail	1.67109		t Critical one-tail	1.71088		t Critical one-tail	1.672		t Critical one-tail	1.672	
P(T<=t) two-tail	0.82133		P(T<=t) two-tail	0.69441		P(T<=t) two-tail	0.037		P(T<=t) two-tail	0.037	
t Critical two-tail	2.001		t Critical two-tail	2.0639		t Critical two-tail	2.002		t Critical two-tail	2.002	
FXGL		250		*FXGL*		300		*FXGL*		350	
Mean	0.93778	0.88427	Mean	0.93778	0.86643	Mean	0.938	0.804	Mean	0.938	0.804
Variance	0.00369	0.00317	Variance	0.00369	0.00175	Variance	0.004	0.002	Variance	0.004	0.002
Observations	82	39	Observations	82	34	Observations	82	46	Observations	82	46
Hypothesized Mean Diff.	0		Hypothesized Mean	0		Hypothesized Mean	0		Hypothesized Mean	0	
df	80		df	88		df	120		df	120	
t Stat	4.7624		t Stat	7.25767		t Stat	14.54		t Stat	14.54	
P(T<=t) one-tail	4.2E-06		P(T<=t) one-tail	7.4E-11		P(T<=t) one-tail	1E-28		P(T<=t) one-tail	1E-28	
t Critical one-tail	1.66413		t Critical one-tail	1.66235		t Critical one-tail	1.658		t Critical one-tail	1.658	
P(T<=t) two-tail	8.4E-06		P(T<=t) two-tail	1.5E-10		P(T<=t) two-tail	3E-28		P(T<=t) two-tail	3E-28	
t Critical two-tail	1.99007		t Critical two-tail	1.98729		t Critical two-tail	1.98		t Critical two-tail	1.98	

	"FXGL" 400		"FXGL" 500	
Mean	0.93778	0.82041	Mean	0.93778 0.78805
Variance	0.00369	0.00125	Variance	0.00369 0.00735
Observations	82	38	Observations	82 47
Hypothesized Mean Diff.	0		Hypothesized Mean	0
df	112		df	73
t Stat	13.0003		t Stat	10.5475
P(T<=t) one-tail	4.3E-25		P(T<=t) one-tail	1.3E-16
t Critical one-tail	1.65857		t Critical one-tail	1.666
P(T<=t) two-tail	8.6E-25		P(T<=t) two-tail	2.5E-16
t Critical two-tail	1.98137		t Critical two-tail	1.993

PERCHLORATE 7 Plastic Dish LENGTH DATA

"FXPL"	"FXGL"	100	200	250	300	350	400	500
0.96373	0.96061	0.98656	0.91685	0.89343	0.89124	0.80349	0.83156	0.80536
0.98884	1.00691	0.78485	0.98704	0.92504	0.90559	0.82198	0.74869	0.84627
0.96393	0.78118	0.96457	0.94291	0.90222	0.87194	0.85225	0.84297	0.86082
0.96692	0.93747	1.02151	0.69525	0.66669	0.66749	0.60232	0.65362	0.62271
0.93378	0.90526	0.96048	0.92528	0.7306	0.83072	0.82046	0.83378	0.87992
0.97269	0.92132	0.94884	0.92726	0.93954	0.8648	0.78581	0.79715	0.85641
0.94552	0.90903	0.92383	0.73645	0.85736	0.92052	0.86048	0.84011	0.90602
0.98199	0.92497	0.91789	0.93571	0.82947	0.85325	0.81388	0.7419	0.87565
0.91786	0.90092	0.97199	0.89668	0.94689	0.91062	0.80089	0.82144	0.86737
0.96128	0.91101	0.91875	0.92415	0.88574	0.91085	0.83179	0.79509	0.69761
0.90314	0.93876	0.67784	0.86862	0.88146	0.89132	0.78051	0.81116	0.8644
0.83935	0.95034	0.92044	0.9767	0.9446	0.88723	0.86229	0.79206	0.83971
0.99366	0.95149	0.98455	0.95705	0.90969	0.87378	0.8378	0.78893	0.79373
0.95838	0.95951	1.02425	0.96098	0.88005	0.89158	0.8359	0.73885	0.86055
0.99311	0.94727	1.0112	0.937	0.87732	0.91597	0.83185	0.86111	0.91143
0.91016	0.98058	0.83245	0.94917	0.87736	0.87343	0.81925	0.76093	0.8587
0.92625	0.95022	0.96884	0.94945	0.86756	0.80179	0.84236	0.86664	0.82866
0.95758	0.94702	0.90089	0.92512	0.91382	0.81269	0.76094	0.83109	0.87533
0.97496	0.97021	0.97615	0.93061	0.90796	0.85807	0.8261	0.80491	0.87383
0.90492	0.93262	0.9011	0.93262	0.85264	0.86449	0.84738	0.84596	0.86662
0.88148	0.93301	"	0.96448	0.88506	0.86663	0.88279	0.87906	0.76553
0.97178	0.94284	"	0.81294	0.91625	0.88752	0.86723	0.82564	0.85593
0.99666	0.89205	"	0.86759	0.92008	0.86632	0.87873	0.8635	0.88482
0.94238	0.9437	"	0.97188	0.89293	0.86378	0.78391	0.8601	0.86102
0.67142	0.96808	"	0.73046	0.91569	0.8773	0.79761	0.81946	0.81014
0.89468	0.97044	"	0.93587	0.92531	0.91767	0.79704	0.82745	0.80242
0.90446	0.96389	"	0.98015	0.84196	0.896	0.80864	0.84393	0.81043
0.9381	0.9275	"	0.90014	0.8437	0.76943	0.76443	0.84835	0.71239
0.98619	0.99122	"	0.94513	0.88962	0.803	0.76917	0.83436	0.7745
0.9419	0.97159	"	0.90081	0.90876	0.87103	0.78697	0.84343	0.4984
0.95665	0.99182	"	0.93829	0.63604	0.93048	0.7592	0.78834	0.72595
0.91443	0.96655	"	0.94242	0.88084	0.76627	0.81032	0.83011	0.67656
0.89526	1.00244	"	0.9133	0.85883	0.8054	0.80376	0.85872	0.7406
"	0.92658	"	0.92624	0.87976	0.84088	0.80173	0.77693	0.68847
"	0.96908	"	0.85785	0.91978	"	0.79206	0.80369	0.72865
"	0.969	"	0.87094	0.91659	"	0.72758	0.82122	0.71837
"	0.99788	"	0.2512	0.91919	"	0.82298	0.84079	0.73456
"	0.96386	"	0.93126	0.899	"	0.78619	0.80268	0.69663
"	1.00916	"	0.9037	0.92556	"	0.75483	"	0.80289
"	0.97393	"	0.95568	"	"	0.82637	"	0.77454
"	0.97626	"	0.89084	"	"	0.66036	"	0.61431
"	0.96004	"	0.90595	"	"	0.81046	"	0.72593
"	0.95332	"	0.7805	"	"	0.79515	"	0.76659
"	0.92165	"	0.96181	"	"	0.75104	"	0.77458
"	0.96055	"	0.9282	"	"	0.72557	"	0.76156
"	0.93744	"	"	"	"	0.80073	"	0.7513
"	0.89867	"	"	"	"	"	"	0.79035
"	0.87806	"	"	"	"	"	"	"
"	0.98369	"	"	"	"	"	"	"

"	0.98229	"	"	"	"	"	"	
"	1.01713	"	"	"	"	"	"	
"	0.99232	"	"	"	"	"	"	
"	0.76779	"	"	"	"	"	"	
"	0.85817	"	"	"	"	"	"	
"	0.90124	"	"	"	"	"	"	
"	0.98346	"	"	"	"	"	"	
"	0.90931	"	"	"	"	"	"	
"	0.90435	"	"	"	"	"	"	
"	0.90818	"	"	"	"	"	"	
"	0.63658	"	"	"	"	"	"	
"	0.91678	"	"	"	"	"	"	
"	0.91435	"	"	"	"	"	"	
"	0.87405	"	"	"	"	"	"	
"	1.00557	"	"	"	"	"	"	
"	0.97778	"	"	"	"	"	"	
"	0.86132	"	"	"	"	"	"	
"	0.97425	"	"	"	"	"	"	
"	0.97252	"	"	"	"	"	"	
"	0.95661	"	"	"	"	"	"	
"	1.00395	"	"	"	"	"	"	
"	0.97004	"	"	"	"	"	"	
"	0.96574	"	"	"	"	"	"	
"	0.75029	"	"	"	"	"	"	
"	0.94022	"	"	"	"	"	"	
"	0.8436	"	"	"	"	"	"	
"	0.92388	"	"	"	"	"	"	
"	0.97577	"	"	"	"	"	"	
"	0.96801	"	"	"	"	"	"	
"	0.97708	"	"	"	"	"	"	
"	0.98962	"	"	"	"	"	"	
"	0.91442	"	"	"	"	"	"	
"	0.9305	"	"	"	"	"	"	
"FXPL"	"FXGL"	100	200	250	300	350	400	500
0.9350	0.9378	0.9298	0.8988	0.8843	0.8684	0.8044	0.8204	0.7881
99.70%	100.00%	99.15%	95.84%	94.29%	92.39%	85.78%	87.48%	84.03%

t-Test: Two-Sample Assuming Unequal Variances

	"FXGL"	"FXPL"		"FXGL"	100		"FXGL"	200
Mean	0.93778	0.93495	Mean	0.93778	0.92985	Mean	0.938	0.899
Variance	0.00369	0.00365	Variance	0.00369	0.00706	Variance	0.004	0.013
Observations	82	33	Observations	82	20	Observations	82	45
Hypothesized Mean Diff	0		Hypothesized Mean	0		Hypothesized Mean	0	
df	59		df	24		df	58	
t Stat	0.22685		t Stat	0.39764		t Stat	2.138	
P(T<=t) one-tail	0.41066		P(T<=t) one-tail	0.34721		P(T<=t) one-tail	0.018	
t Critical one-tail	1.67109		t Critical one-tail	1.71088		t Critical one-tail	1.672	
P(T<=t) two-tail	0.82133		P(T<=t) two-tail	0.69441		P(T<=t) two-tail	0.037	
t Critical two-tail	2.001		t Critical two-tail	2.0639		t Critical two-tail	2.002	

"FXGL" 250		"FXGL" 300		"FXGL" 350	
Mean	0.93778	0.88427	Mean	0.93778	0.86643
Variance	0.00369	0.00317	Variance	0.00369	0.00175
Observations	82	39	Observations	82	34
Hypothesized Mean Diff	0		Hypothesized Mean	0	
df	80		df	88	
t Stat	4.7624		t Stat	7.25767	
P(T<=t) one-tail	4.2E-06		P(T<=t) one-tail	7.4E-11	
t Critical one-tail	1.66413		t Critical one-tail	1.66235	
P(T<=t) two-tail	8.4E-06		P(T<=t) two-tail	1.5E-10	
t Critical two-tail	1.99007		t Critical two-tail	1.98729	
"FXGL" 400		"FXGL" 500			
Mean	0.93778	0.82041	Mean	0.93778	0.78805
Variance	0.00369	0.00125	Variance	0.00369	0.00735
Observations	82	38	Observations	82	47
Hypothesized Mean Diff	0		Hypothesized Mean	0	
df	112		df	73	
t Stat	13.3003		t Stat	10.5475	
P(T<=t) one-tail	4.3E-25		P(T<=t) one-tail	1.3E-16	
t Critical one-tail	1.65857		t Critical one-tail	1.666	
P(T<=t) two-tail	8.6E-25		P(T<=t) two-tail	2.5E-16	
t Critical two-tail	1.98137		t Critical two-tail	1.993	

"FXGL" 250		"FXGL" 300		"FXGL" 350	
Mean	0.93778	0.88427	Mean	0.93778	0.86643
Variance	0.00369	0.00317	Variance	0.00369	0.00175
Observations	82	39	Observations	82	34
Hypothesized Mean Diff	0		Hypothesized Mean	0	
df	80		df	88	
t Stat	4.7624		t Stat	7.25767	
P(T<=t) one-tail	4.2E-06		P(T<=t) one-tail	7.4E-11	
t Critical one-tail	1.66413		t Critical one-tail	1.66235	
P(T<=t) two-tail	8.4E-06		P(T<=t) two-tail	1.5E-10	
t Critical two-tail	1.99007		t Critical two-tail	1.98729	
"FXGL" 400		"FXGL" 500			
Mean	0.93778	0.82041	Mean	0.93778	0.78805
Variance	0.00369	0.00125	Variance	0.00369	0.00735
Observations	82	38	Observations	82	47
Hypothesized Mean Diff	0		Hypothesized Mean	0	
df	112		df	73	
t Stat	13.3003		t Stat	10.5475	
P(T<=t) one-tail	4.3E-25		P(T<=t) one-tail	1.3E-16	
t Critical one-tail	1.65857		t Critical one-tail	1.666	
P(T<=t) two-tail	8.6E-25		P(T<=t) two-tail	2.5E-16	
t Critical two-tail	1.98137		t Critical two-tail	1.993	

PERCHLORATE TEST 8 LENGTH DATA

"FXGL"	"FXPL"	100	200	250	300	350	400	500
0.9515	0.9766	0.9403	0.8757	0.9102	0.9099	0.8490	0.7976	0.7955
0.9961	0.9940	0.9793	0.9204	0.8548	0.8286	0.8941	0.7097	0.7510
0.9952	0.9538	0.8852	0.8453	0.9519	0.9017	0.8581	0.7681	0.8015
0.9601	0.9264	0.9190	0.8661	0.8757	0.8855	0.8647	0.7984	0.7561
0.9390	0.9927	0.9158	0.9176	0.9394	0.8714	0.8451	0.7999	0.7382
0.9665	0.9828	0.9456	0.9838	0.8836	0.8387	0.8467	0.6997	0.8038
0.9584	0.9080	0.8675	0.9521	0.8922	0.8606	0.8530	0.7770	0.7835
0.9693	0.9259	0.8886	0.8870	0.9300	0.8770	0.8379	0.7761	0.7680
0.9162	0.9337	0.9818	0.9228	0.8232	0.8159	0.9727	0.8154	0.7984
1.0041	1.0141	0.9393	0.9627	0.8809	0.8862	0.8616	0.8122	0.7914
0.9422	1.0038	0.9048	0.9157	0.9146	0.8651	0.7804	0.7695	0.8235
0.9883	0.8882	0.9409	0.9393	0.9594	0.8690	0.8097	0.7418	0.8033
0.9662	0.9630	0.9055	0.8832	0.7611	0.8232	0.8326	0.8385	0.7788
0.8821	1.0056	0.8910	0.7568	0.8505	0.8511	0.7754	0.7693	0.7777
0.9835	1.0258	0.9736	0.8889	0.9613	0.8708	0.8570	0.8025	0.6619
1.0432	0.9158	0.9149	0.8363	0.9392	0.8342	0.7963	0.8319	0.7462
0.8606	0.9772	0.9087	0.9559	0.8189	0.7997	0.8480	0.8614	0.8016
1.0102	0.9524	0.8953	0.9942	0.9251	0.7840	0.8366	0.8206	0.7513
1.0013	1.0031	0.8688	0.9061	0.8853	0.8522	0.8438	0.8151	0.7886
1.0092	0.9703	0.8598	0.9571	0.9204	0.8607	0.8326	0.6899	0.7006
1.0171	0.9803	0.9778	0.9860	0.8140	0.8195	0.8787	0.8027	0.7559
1.0105	0.9929	0.9408	0.8947	0.9438	0.7784	0.8087	0.7786	0.6767
0.9734	0.9826	0.9298	0.7965	0.9438	0.8395	0.8635	0.7798	0.8209
1.0494	0.9815	0.9687	0.9302	0.8548	0.8830	0.7443	0.8592	"
0.9053	0.9820	0.9380	0.9132	0.8406	0.8343	0.7594	0.8682	"
0.9868	1.0058	0.7731	0.9797	0.8422	0.8658	0.8375	0.7964	"
1.0009	1.0264	0.9607	0.9820	0.8630	0.8410	0.8757	0.8252	"
1.0145	0.8977	0.8771	0.9475	0.8437	0.8128	0.8414	0.8076	"
0.9836	0.9260	0.9644	0.8946	0.8891	0.8693	0.8255	0.8227	"
0.9943	1.0195	0.9512	0.9464	0.8761	0.7839	0.8282	0.7967	"
0.9847	1.0175	0.7225	0.9572	0.7715	0.8159	0.8549	"	"
0.9915	1.0078	0.8533	1.0051	0.9206	0.8822	0.8150	"	"
0.9825	0.9712	0.9394	0.9927	0.9419	0.8786	0.8365	"	"
0.9911	1.0012	0.8623	0.9371	0.9286	0.8292	0.7338	"	"
1.0027	0.9650	0.9963	0.9127	0.9040	0.8867	0.8870	"	"
1.0300	0.9746	0.9688	0.9226	0.8642	0.8164	0.8402	"	"
1.0187	"	0.9096	0.9057	0.8712	0.8728	0.8565	"	"
0.9879	"	0.9724	0.9486	0.8849	0.8426	0.8427	"	"
0.9860	"	0.9794	0.7287	0.9112	0.8533	0.8626	"	"
0.9604	"	0.9647	0.9640	0.8581	0.8993	0.9308	"	"
0.9738	"	0.7968	0.9540	0.9249	0.9046	0.9179	"	"
0.9788	"	0.8569	0.9912	0.8647	0.8703	0.8268	"	"
0.9687	"	0.9364	"	0.9121	0.8496	0.8974	"	"
0.9227	"	0.9292	"	0.9120	0.8750	0.7986	"	"
0.9874	"	0.9130	"	0.9396	0.8367	0.8500	"	"
1.0040	"	0.8070	"	0.9146	0.7837	"	"	"
0.9697	"	0.8507	"	0.8123	"	"	"	"
0.7750	"	0.9071	"	0.9000	"	"	"	"
0.7391	"	0.9539	"	"	"	"	"	"
0.9699	"	1.0032	"	"	"	"	"	"
0.8829	"	"	"	"	"	"	"	"
1.0166	"	"	"	"	"	"	"	"
0.9633	"	"	"	"	"	"	"	"
0.8955	"	"	"	"	"	"	"	"
1.0251	"	"	"	"	"	"	"	"
1.0022	"	"	"	"	"	"	"	"
0.8756	"	"	"	"	"	"	"	"
0.9234	"	"	"	"	"	"	"	"
0.9784	"	"	"	"	"	"	"	"
0.8967	"	"	"	"	"	"	"	"
0.9617	"	"	"	"	"	"	"	"

0.9191	**	**	**	**	**	**	**	**	
0.9379	**	**	**	**	**	**	**	**	
0.9785	**	**	**	**	**	**	**	**	
0.9332	**	**	**	**	**	**	**	**	
0.9293	**	**	**	**	**	**	**	**	
1.0109	**	**	**	**	**	**	**	**	
0.9386	**	**	**	**	**	**	**	**	
0.9791	**	**	**	**	**	**	**	**	
0.7979	**	**	**	**	**	**	**	**	
1.0182	**	**	**	**	**	**	**	**	
0.9556	**	**	**	**	**	**	**	**	
1.0060	**	**	**	**	**	**	**	**	
0.9218	**	**	**	**	**	**	**	**	
0.9914	**	**	**	**	**	**	**	**	
0.9207	**	**	**	**	**	**	**	**	
0.9978	**	**	**	**	**	**	**	**	
0.9991	**	**	**	**	**	**	**	**	
1.0109	**	**	**	**	**	**	**	**	
0.9532	**	**	**	**	**	**	**	**	
0.8729	**	**	**	**	**	**	**	**	
0.9664	**	**	**	**	**	**	**	**	
1.0309	**	**	**	**	**	**	**	**	
0.9540	**	**	**	**	**	**	**	**	
1.0126	**	**	**	**	**	**	**	**	
1.0043	**	**	**	**	**	**	**	**	
0.9858	**	**	**	**	**	**	**	**	
0.9332	**	**	**	**	**	**	**	**	
0.9410	**	**	**	**	**	**	**	**	
0.9647	**	**	**	**	**	**	**	**	
0.9826	**	**	**	**	**	**	**	**	
0.8985	**	**	**	**	**	**	**	**	
1.0185	**	**	**	**	**	**	**	**	
0.9689	**	**	**	**	**	**	**	**	
"FXGL"	"FXPL"	100	200	250	300	350	400	500	
Average	0.9644	0.9735	0.9142	0.9204	0.8880	0.8524	0.8424	0.7944	0.7724
% G Control	100.00%	100.94%	94.79%	95.44%	92.08%	88.38%	87.35%	82.37%	80.09%

t-Test: Two-Sample Assuming Unequal Variances

	"FXGL"	100	"FXGL"	200	"FXGL"	250		
Mean	0.964444	0.9142	Mean	0.964444	0.920431	Mean	0.96444	0.88777
Variance	0.002916	0.003451	Variance	0.002916	0.003735	Variance	0.00292	0.00232
Observations	94	50	Observations	94	42	Observations	94	47
Hypothesized Mear	0		Hypothesized Mean I	0		Hypothesized Mean I	0	
df	93		df	71		df	102	
t Stat	5.023616		t Stat	4.01859		t Stat	8.55036	
P(T<=t) one-tail	1.22E-06		P(T<=t) one-tail	7.19E-05		P(T<=t) one-tail	6.4E-14	
t Critical one-tail	1.661404		t Critical one-tail	1.666599		t Critical one-tail	1.65993	
P(T<=t) two-tail	2.44E-06		P(T<=t) two-tail	0.000144		P(T<=t) two-tail	1.3E-13	
t Critical two-tail	1.9858		t Critical two-tail	1.993944		t Critical two-tail	1.98349	
	"FXGL"	300	"FXGL"	350	"FXGL"	400		
Mean	0.964444	0.852381	Mean	0.964444	0.842416	Mean	0.96444	0.79439
Variance	0.002916	0.001321	Variance	0.002916	0.002002	Variance	0.00292	0.00187
Observations	94	46	Observations	94	45	Observations	94	30
Hypothesized Mear	0		Hypothesized Mean I	0		Hypothesized Mean I	0	
df	124		df	103		df	60	
t Stat	14.49949		t Stat	14.04334		t Stat	17.5875	
P(T<=t) one-tail	8.97E-29		P(T<=t) one-tail	5.7E-26		P(T<=t) one-tail	1.2E-25	
t Critical one-tail	1.657236		t Critical one-tail	1.659782		t Critical one-tail	1.67065	
P(T<=t) two-tail	1.79E-28		P(T<=t) two-tail	1.14E-25		P(T<=t) two-tail	2.3E-25	
t Critical two-tail	1.979279		t Critical two-tail	1.983262		t Critical two-tail	2.0003	

"FXGL" 500		
Mean	0.964444	0.772436
Variance	0.002916	0.001426
Observations	94	23
Hypothesized Mean	0	
df	47	
t Stat	19.91027	
P(T<=t) one-tail	7.59E-25	
t Critical one-tail	1.677927	
P(T<=t) two-tail	1.52E-24	
t Critical two-tail	2.011739	

Figure 1

